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This Month

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Citrus Insect Control For February 1952

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LAKE ALFRED

Mite activity has slowed somewhat in the past week or two, but both rust mites and purple mites are still abundant and may be troublesome in some groves during February. This will be especially true where a dormant spray of sulfur and DN was not applied during January.

Both red and purple scales have shown a recent increase in the percent of young scales. A major hatch is not anticipated at this time but there is likely to be more or less continuous hatching all through February. This is not a favorable month for scale control but in cases where there has been an excessive carryover it may be necessary to spray to avoid damage to the new growth.

Spray Programs

February is likely to be a period when careful selection should be made of groves to be sprayed so that only those groves will be treated where a special problem requires it. If the weather continues to be mild, there will be very succulent growth in a high percentage of the groves, and some of the insecticides in common use are toxic to succulent growth. However, in some groves it may be necessary to apply control measures to prevent excessive insect or mite injury.

Since purple and red scale infestations have shown a slight increase during the past two weeks, it may be advisable to use a scalicide where either or both of these species of scales are numerous. During February a high percentage of scales will be in the adult and egg stages which means there will be a more or less continuous hatching of eggs, if mild weather continues. Red scale crawlers, and to a certain extent purple scale, will infest the new foliage before it matures and may distort it. The greatest danger of infestations of red scale on new foliage is in groves where the old fruits are heavily infested. As the eggs hatch, the crawlers move from the fruit onto the young foliage. An oil emulsion at 1.3 percent actual oil is the safest scalicide to apply on young foliage. The limitations of oil emulsions are: the possibilities of leaf drop and dead wood following an application of oil on trees suffering from lack of moisture, tree damage if freezing weather follows the application, and interference with fruit coloring. Oil sprays will retard coloring of Valencias if they have not colored at the time of the oil application. Parathion at 1 2/3 pounds per 100 gallons can be used if only pinpoint growth is present, but where the leaves have unfolded, injury may result from such an application. It will be necessary for the grower to decide which is the most practical thing to do under his specific conditions.

Purple mites, no doubt, will be numerous in some groves. Neither DN Dry Mix nor DN 111 should be applied on very succulent foliage. However, DN 111 is less toxic than DN Dry Mix and can be used after the new growth has matured. Oil sprays can be used with the limitations mentioned under scale control. Other miticides that are effetive and have not burned succulent foliage include Ovotran, Neotran, and Aramite. Aramite has not been as effective as Ovotran and Neotran. Any of the above miticides are also effective for the control of six-spotted mites.

All of these miticides are compatible with sulfur and parathion. Zinc also may be included with these sprays if needed.

Rust mite infestations should be controlled with sulfur to prevent greasy spot. Heavy infestations are now present on the leaves where no sulfur has been applied since last fall.

For detailed information on combination sprays it is urged that the grower refer to the 1951 or 1952 "Better Fruit Program." For information not included in the Spray Schedule consult the Citrus Experiment Station at Lake Alfred or the Indian River Field Laboratory at Fort Pierce.

* Written January 24, 1952. Reports of surveys by Harold Holtsberg, Cocoa; J. W. Davis, Tavares; K. G. Townsend, Tampa; J. B. Weeks, Avon Park; and E. D. Harris, Jr., Lake Alfred.

The U. S. Department of Agriculture has announced that it has purchased 186,460 cases of No. 3 cylinder cans of concentrated orange juice (3 to 1 ratio) for distribution to school lunch programs and other eligible outlets. Delivery will be made during the period January 7 through Febraury 9, 1952.

T e purchase was made at an average price of $6.68 per case, the equivalent of $1.55 per gallon. This is the commodity cost, f. o. b. shipping point, and does not include transportation to destination.

Florida Citrus Museum Opens At Winter Haven

The "granddaddy" of the modern frozen citrus concentrates plants, which have been worth hundreds of millions of dollars to the Florida citrus grower have an honored place in the new Florida Citrus Museum which is being established at Winter Haven.

Phil Lucey, general manager of the museum, which is expected to attract thousands of visitors to Winter Haven, opened on Jan. 15, said that the pilot plant, developed by Dr. L. G. McDowell, research director of the Florida Citrus Commission and his associates, will put into operational practice their theories on new methods of concentrating citrus juices, as a feature attraction.

In addition to the concentrates pilot plant, there is a full-scale reproduction of one of the state's first fresh fruit packing houses, along with the improvised equipment used in the early days of the industry.

Considerable attention is being paid to the modern development of the industry, with "flash backs" to the early days to show the contrast over the years. Big animated displays, dioramas and murals are used to give the visitor a complete story on Florida citrus and its many uses.

PIONEER CITRUS CANNER PASSES

Carroll E. Lindsey, one of the American Canning industry's major figures for nearly twenty-five years, died in Lakeland on January 5.

Serving as president of the National Canners Association in 1942, he was honored by unanimous demand of the canning industry for his leadership of a second term in 1943. Spending a great deal of his time in Washington during the war as a member of various committees and boards dealing with provision of civilian and military food supplies, Mr. Lindsey was valuable both to the canning industry and to the nation. For three of the six years he was a member of the National Canners Association Legislative Committee, Mr. Lindsey was its chairman.

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Some Results of Irrigation Research With Florida Citrus

The simple practice of supplying water in addition to that provided by rainfall for crop production has been used by Florida citrus growers for many years. Problems concerning irrigation may be classified into three general categories; those related to delivery and application of irrigation water, those which are specifically concerned with the soil, and those which are related to the plant itself. The discussion in this paper is primarily concerned with the latter, since they are of considerable importance to the growers, and since only a minimum of information is available. Irrigation problems and results of experimental work as discussed here apply more specifically to the central ridge citrus section of Florida than to the coastal sections of the state.

Procedure and Results

In an attempt to learn more about the reaction of citrus trees to varying conditions of soil moisture, three different types of irrigation studies have thus far been undertaken. The first two of these studies were of short duration, and have already been terminated. The third one, however, will be continued for a number of years.

Continuous Abundant Soil Moisture Compared With No Irrigation

During the growing season of 1948, mature Marsh and Silver

BY JOHN W. SITES, HERMAN J. REITZ AND E. J. DESZYCK. FLORIDA CITRUS EXPERIMENT STATION, LAKE ALFRED.

Cluster grapefruit trees in Block II at the Citrus Experiment Station were selected to study the effect of continuous high soil moisture on the quality of fruit produced. Trees from adjacent rows on a moderate slope were selected, with the upper trees receiving no irrigation whereas the trees in the immediate lower row were irrigated weekly at the rate of 500 gallons per tree per week throughout the season from bloom until harvest. Fruit samples collected from these trees on September 17, October 29 and December 2, 1948, provided the data presented in Tables 1 and 2. Briefly, these data show that fruit grown under conditions of abundant soil moisture contained more juice, less soluble solids, and less titratable acid than did fruit grown without irrigation. The soluble solids/titratable acid ratio of the juice also was slightly higher but there was no consistent difference in the Vitamin C content. Of particular interest as revealed by these data is the fact that the total grams of soluble solids present on a "per fruit" basis under these varying conditions of soil moisture are in the majority of cases almost identical. The total grams of titratable acid per fruit data show the general trend (although these data are more variable).

Other characteristics of the fruit and trees were also studied. The size of the fruit was approximately one commercial size larger from trees which received the irrigation treatment. Early bloom fruit from irrigated trees did not grade out as well on the grading belt, the percentage of No. 1 grade being lower and the No. 3 grade higher for both varieties (Table 3).

During May and June, 1948, rainfall was low. The unirrigated trees toward the end of June showed some wilting during the late afternoons. Following rains that occurred in July, these trees produced a rather heavy late bloom (Table 3) and thus a high percentage of the total crop from the unirrigated trees was late bloom fruit. Under these conditions the amount of late bloom fruit produced was influenced very markedly by the irrigation treatment.

Continuous Abundant Soil Moisture Compared With Regulated Drought Periods

The internal quality of citrus fruit as judged by the soluble solids and acid content is known to vary widely between certain seasons.

Table 1.
Internal Quality of Silver Cluster Grapefruit as Affected by Weekly Irrigation and No Irrigation Treatments

	Percent Juice by Weight	Ml. Juice Per Fruit	Brix	Grams Soluble Solids Per Fruit	Percent Acid	Grams Titratable Acids Per Fruit	Ratio Brix/Acid	Vit. C mg./100 Ml. Juice
September 17, 1948								
No Irrigation	32.96	180	9.53	17.8	1.53	2.9	6.25	38.2
Irrigation	35.07	220	8.48	20.5	1.33	3.2	6.38	36.2
October 29, 1948								
No Irrigation	47.37	281	9.27	26.8	1.36	4.0	6.84	34.8
Irrigation	50.08	305	8.60	26.7	1.26	3.9	6.87	35.1
December 2, 1948								
No Irrigation	44.3	257	9.70	25.9	1.41	3.8	6.88	34.9
Irrigation	44.6	280	8.40	24.3	1.17	3.4	7.22	32.9

Table 2
Internal Quality of Marsh Grapefruit as Affected by Weekly Irrigation and No Irrigation Treatments

	Percent Juice by Weight	Ml. Juice Per Fruit	Brix	Grams Soluble Solids Per Fruit	Percent Acid	Grams Titratable Acids Per Fruit	Ratio Brix/Acid	Vit. C mg./100 Ml. Juice
September 17, 1948								
No Irrigation	41.05	162	9.60	16.1	1.56	2.6	6.15	37.1
Irrigation	44.82	190	8.70	15.9	1.28	2.3	6.80	40.1
October 29, 1948								
No Irrigation	50.93	214	9.20	20.1	1.415	3.1	6.50	35.0
Irrigation	54.75	241	8.40	20.7	1.16	2.9	7.24	38.3
December 2, 1948								
No Irrigation	49.6	198	9.60	19.9	1.35	2.8	7.11	36.1
Irrigation	49.4	234	8.30	20.1	1.085	2.6	7.65	37.2

Table 3
Grade and Size of Fruit as Affected by Weekly Irrigation and No Irrigation Treatments

Treatments	Percentage Late Bloom Fruit	Early Bloom Fruit Percent U. S. Grades No. 1	No. 2	No. 3	Ave. Diam.
Marsh					
Irrigation	1.5	26.88	34.08	39.04	4.11
No Irrigation	54.8	40.26	30.71	29.03	3.84
Silver Cluster					
Irrigation	9.4	13.91	29.00	57.09	4.67
No Irrigation	78.5	19.51	39.05	41.42	4.56

Previous preliminary studies of weather and fruit quality showed a high negative correlation between the total annual rainfall and the soluble solids ($r=.960$) and acid ($r=.931$) content of Marsh and Duncan grapefruit. With the object in view of acquiring additional information about the relationship between soil moisture and fruit quality, an experiment was started in 1949 in a Hamlin orange block wherein it was possible to compare the fruit produced by trees growing under conditions of continuous abundant soil moisture with that produced by trees growing under similar conditions except for a regulated dry period. The dry periods were of three months duration and covered the portions of the year as shown in Table 4. The establishment of dry periods was accomplished by building a portable metal shed which could be placed under the branches of pairs of trees, thus preventing rainfall reaching the soil over an area extending approximately five feet or more beyond the canopy of the trees. Water collected on the roof was diverted beyond the experimental area, Fig. 1. This shed was moved from one pair of trees to another for each of the three month dry periods studied. Three pairs of check trees were given an application of irrigation water weekly at a rate sufficient to raise the soil moisture approximately to field capacity to a depth of four feet. The amount of water applied per tree was ascertained by determining the percentage of soil moisture just previous to irrigation by the method developed by Bouyoucos (1). The same weekly procedure was followed on all other trees in the experiment except those which were being maintained as "dry period" trees. In determining soil moisture previous to irrigation, two samples per tree were taken to a depth of four feet. These samples were composited into a single sample for any given pair of trees.

Results of analyses of fruits sampled early and late in each of the two seasons in which the experiment was conducted are presented in Table 4. These data show several important things in connection with the effect of weather and irrigation on fruit quality. Hamlin oranges from trees receiving continuous abundant soil moisture like the Marsh and Silver Cluster grapefruit grown under like conditions i.e., and previously described, showed low soluble solids and low titratable acid content. Regulated drought periods in the growth cycle of these trees has been responsible for some very interesting and speculative results which are summarized as follows; comparisons in all cases, unless otherwise specified being made with fruit produced by trees which received continuous abundant moisture during the **entire** yearly period.

1. Trees growing in soils supplied with continuous abundant moisture except during January, February, and March produced fruit with a moderate increase in titratable acidity (approximate average 9%) but were not different in any other respect except that the ratio of the juice was lowered in proportion to the increase in acid content.

2. Trees under conditions of continuous abundant soil moisture except during April, May, and June produced fruit with a slightly higher soluble solids (approximate average increase 5%) and Vitamin C content, and with a marked increase in the titratable acid content of the juice (approximate average 20%). The ratio of the juice was lowered in proportion to the increase in acid content.

3. Trees growing under conditions of continuous abundant soil moisture except during July, August, and September produced fruit with a marked increase in percentage soluble solids of the juice and in total grams of soluble solids per fruit, (approximate average increase 20%), a marked increase in percentage titratable acidity, a slight increase in the Vitamin C

Table 4
The Effect of Continuous Abundant Soil Moisture and Regulated Drought Periods on the Internal Quality of Hamlin Oranges

Dry Period	Percent Juice by Weight	Ml. Juice Per Fruit	Brix	Grams Sol. Solids Per Fruit	Percent Titratable Acid	Grams Tit. Acid Per Fruit	Ratio Brix/Acid	Mgs. Vit. C/ 100 Ml. Juice
				October 5, 1949, Size 288				
None	41.5	58	8.1	4.5	1.09	.606	7.51	53.7
Jan. Feb. Mar.	45.8	61	8.20	4.8	1.22	.720	6.72	52.6
Apr. May. June	43.2	62	8.50	5.1	1.47	.882	5.78	59.8
July, Aug. Sept.	41.5	56	10.10	5.5	1.47	.794	6.87	58.3
Oct. Nov. Dec.	41.9	60	8.00	4.7	1.15	.679	6.96	51.3
				October 9, 1950, Size 200				
None	54.52	100	8.45	8.7	0.85	.802	9.91	53.0
Jan. Feb. Mar.	55.49	94	8.55	8.4	0.91	.86	9.39	50.8
Apr. May, June	58.69	106	8.85	9.7	0.97	1.05	9.12	56.2
July, Aug. Sept	56.84	102	10.00	10.6	0.95	1.01	10.53	55.7
Oct. Nov. Dec.	57.36	109	8.55	9.7	0.91	0.90	9.39	48.6
				January 5, 1950, Size 250				
None	47.8	80	9.8	8.1	0.69	.573	14.08	59.2
Jan. Feb. Mar.	47.6	76	9.7	7.7	0.69	.545	14.06	58.2
Apr. May, June	50.0	79	10.2	8.4	0.81	.664	12.59	65.6
July, Aug. Sept.	48.8	77	10.85	8.8	0.78	.632	14.86	59.3
Oct. Nov. Dec.	48.6	81	10.3	8.8	0.73	.621	14.11	57.8
				December 12, 1950, Size 200				
None	50.79	102	9.18	9.7	0.75	.794	12.[illegible]	51.5
Jan. Feb. Mar.	50.34	102	9.00	9.5	0.84	.890	10.71	50.5
Apr. May, June	51.27	107	10.20	10.9	0.83	.888	12.29	56.8
July, Aug. Sept.	53.56	108	10.30	11.5	0.73	.818	14.11	49.7
Oct. Nov. Dec.	53.48	112	8.75	101.	0.76	.874	11.51	46.3

content, and with no consistent difference in the ratio of the juice.

4. Trees growing under conditions of continuous abundant soil moisture except during October, November, and December produced fruit not appreciably different in composition from the continuously irrigated check trees.

Since limited space prevents presentation of data, the following statements summarize other studies made of fruit from these plots.

1. Continuous irrigation increased granulation or dryness of fruit at the stem end as compared to fruit harvested from trees kept dry during any three month period after the crop had set.

2. A dry period of three months at any time after the fruit was set reduced the size of the fruit, and the reduction in size was never entirely regained by subsequent irrigation.

Irrigation Applied Only During Drought Periods (commercial practice) As Compared With No Irrigation

At the Citrus Experiment Station triplicated plots are compared to study the effect of irrigation versus no irrigation. Five varieties of approximately 12 year old trees budded on rough lemon stock are included in this experiment, and the plots receive 2½ inches of water at each irrigation. Another experiment is conducted in an older block of Valencia oranges and Marsh grapefruit trees on lemon stock located at Haines City, Florida*. In this grove, known as the Sample grove, the amount of water is varied so that duplicate plots receive 1½, 2½, and 3½ inches of water per application. The irrigation record for these plots is shown in Table 5. In both groves, irrigation is applied only when the condition of the trees and weather conditions indicate it is required.

It is evident from the data presented in Table 6 that the soluble solids and titratable acid content of the juice has been lower in fruit sampled from irrigated trees in the 1949 and 1950 seasons. During these two seasons there were no exceptions to this trend among the five varieties Hamlin, Pineapple, Valencia, Duncan, and Marsh under test. In most instances, supplemental irrigation is also associated with a reduction of the Vitamin C content of the fruit, although these data have been less consistent than those for soluble solids and titratable acid. The ratio (soluble solids/titratable acid), the percentage of juice by weight per fruit, and the volume of extractable juice per fruit were frequently higher in fruit taken from irrigated trees but no statistical differences in these data are evident to date. Although there were pronounced differences in the percentage soluble solids content of the juice, as affected by irrigation, these differences are not so apparent in the data for total grams soluble solids

*This experiment was started originally in cooperation with the Soil Conservation Service.

Table 5
Irrigation Application Schedule

Year	Sample Grove Haines City, Fla.	Citrus Experiment Station Grove, Lake Alfred
1946	April 20	
1946	December 5	
1947	January 10	
1948		May 25
1948	June 17	June 25
1948	November 20	November 10
1948		December 7
1949	February 25	March 5
1949	May 10	May 27
1949		November 9
1950	February 15	February 3
1950		June 21
1950		November 15*
1951	March 26	April 5
1951	June 7**	

* Grapefruit only
** Oranges only

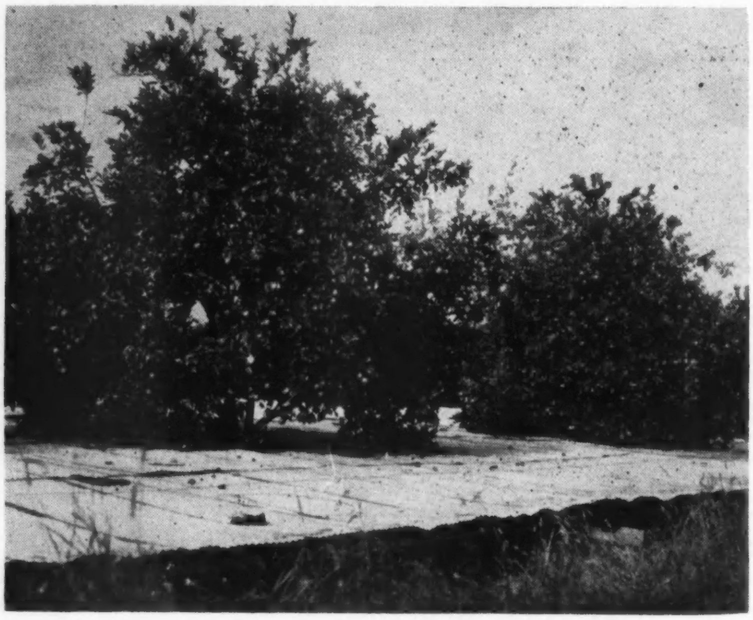

FIGURE 1—A section of the portable shed constructed beneath Hamlin orange trees to intercept rainfall and make possible periods of extended low soil moisture.

per fruit. This means that in most cases the increase in juice volume of fruit from irrigated trees of any given size has been great enough to compensate for the lower percentage soluble solids content of the juice. As is evident from these data, however, there are some exceptions to this general trend.

During the 1950 season, the oranges and grapefruit were not irrigated at the same time, Table 5, only the grapefruit having been irrigated in the fall. As is shown in Table 6 the three varieties of oranges showed no significant differences in the soluble solids content of fruit from the irrigated and unirrigated trees. This fruit did show a significant decrease in titratable acid due to irrigation. Grapefruit trees which were irrigated at approximately the same time as the oranges, plus an additional irrigation in November, showed significant reductions in both the soluble solids and acid contents of the juice.

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Table 6
Juice Constituents of Oranges and Grapefruit as Affected by Irrigation, Citrus Station, Blocks XVIII & XIX, 1948-50

Treatment	Year	Brix	Percent Acid	Ratio	Mg. Vit. C/ 100 Ml. Juice	Volume Juice/ Fruit, Ml.	Gram Sol. Solid Per Fruit
			Hamlin Oranges				
Irrigated	1948	9.80	0.84	12.15	59.4	78	7.94
Unirrigated		10.25**	0.89**	12.01	59.8	80	8.51
Irrigated	1949	8.63	0.86	10.44**	51.5	74*	6.56
Unirrigated		9.05**	0.98	9.58	57.5**	70	6.52
Irrigated	1950	9.53	0.93	10.80**	53.2	85	8.39
Unirrigated		9.59	1.06**	9.58	52.8	80	7.96
			Pineapple Oranges				
Irrigated	1948	11.01	1.05	10.65	71.3	93*	10.57
Unirrigated		11.72*	1.14**	10.41	72.5	90	11.02
Irrigated	1949	9.48	0.90	11.36	60.4	83	8.15
Unirrigated		10.85**	0.98**	11.44	66.0**	84	9.55**
Irrigated	1950	11.34	0.96	11.95**	59.5	100**	11.34
Unirrigated		11.30	1.07**	10.60	61.0	94	11.07
			Valencia Oranges				
Irrigated	1948	11.45	0.96	12.33	53.6	110	13.17
Unirrigated		12.15	1.00*	12.71	55.0	108	13.73
Irrigated	1949	10.65	0.83	13.56*	59.5	105	11.61
Unirrigated		11.59**	0.96**	12.71	53.7**	104	12.63**
Irrigated	1950	10.39	1.00	11.11	42.2	132**	14.23
Unirrigated		10.70	1.09**	10.55	44.0**	127	14.12
			Duncan Grapefruit				
Irrigated	1948	9.04	1.37	6.62**	45.0**	201	18.80
Unirrigated		9.13	1.45**	6.33	43.6	191	18.08
Irrigated	1949	8.17	1.32	6.36**	41.5	244	20.59*
Unirrigated		8.62**	1.46**	6.16	45.0**	212	18.88
Irrigated	1950	9.26	1.42	6.51**	37.7	225**	21.58*
Unirrigated		9.51	1.58**	6.02	39.6**	198	19.50
			Marsh Grapefruit				
Irrigated	1948	8.50	1.21	7.09	42.9	180**	15.81
Unirrigated		8.90	1.27	7.06	42.3	169	15.56
Irrigated	1949	7.31	1.28	5.84	35.2	211	15.86
Unirrigated		8.17**	1.43**	5.95	41.1**	190	16.01
Irrigated	1950	8.28	1.35	6.18	36.0	230**	17.31
Unirrigated		9.03**	1.46**	6.24	38.3	182	16.98

*—Significantly different at 5% level
**—Significantly different at 1% level

Flavor Changes In Stored Canned Orange Juice [1]

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INTRODUCTION

There have been several theories proposed to account for the development of disagreeable pungent flavor in canned citrus juice on storage. These fall into three main categories: that the off-flavors are caused by oxidation due to the inclusion of atmospheric oxygen in the can (8) or by changes in peel oil constituents (1), or by changes in the lipid constituents (3,4,9). A number of other changes take place on storage such as darkening, loss of cloud, and loss of ascorbic acid but these have not been shown to affect the flavor although they may accompany flavor changes and possibly are related.

The first theory—that atmospheric oxygen was the cause of off-flavor development—is not considered here in detail for while deaeration has been shown to be of some importance in preventing deterioration initially, it does not protect against the ultimate development of bad flavors on long storage at usual warehouse temperatures (2,10). In some canneries where deaeration is carried out, it is done primarily to control foaming at the filler-bowl, or is incidental to a de-oiling operation.

Peel Oil Changes

There are in the literature a number of references to the effect of peel oil on the development of bad flavors in canned orange juice during storage. Boyd and Peterson (2) considered that, under certain conditions, concentrations of oil as low as 0.01% could give rise to objectionable flavors. Curl and Veldhuis (3,4), on the other hand, concluded from their experiments on orange and tangerine juices that some peel oil was necessary for characteristic juice flavor, that it did not apparently contribute to off-flavor development, and that it seemed, in fact, to mask some of the off-flavors that did develop.

More recently, Blair and associates (1) have studied this problem and have concluded that changes in the peel oil constitutes are responsible for the pungent flavor deterioration of canned citrus juices during storage. These investigators at first proposed in a private communication that the D-limonene of the peel oil underwent partial recemization during storage to the l-form and that this form was responsible for the characteristic aged flavor that develops. A later proposal (1) still considers the terpene fraction of the peel oil, particularly the D-limonene, as the source of the off-flavor, but proposes a quite different mechanism. In the new concept the acid of the juice is thought to promote a series of hydration—dehydration reactions, probably of the D-limonene, which eventually results in some of this constituent being lost to the water phase of the juice as polyhydroxy compounds, some being converted to terpineol, and some to 1,4-cineole, the latter being produced when the acidity and storage temperatures are high. It is 1,4-cineole that is thought to be responsible for the typical, pungent off-flavor that develops in citrus juices on storage. Blair and his associates supported their views by data based on taste-tests of oil-free packs, measurement of peel oil loss on storage and infra-red absorption curves.

Changes in the Juice Lipids

The possibility that off-flavors arise from changes which take place in the lipid fractions of the juices has been investigated by several workers of the Bureau of Agricultural and Industrial Chemistry.

Investigations by Nolte and von Loesecke (9), Swift (11), Curl (3), and Curl and Veldhuis (4). In 1940 Nolte and von Loesecke (9) studied the lipid fractions from fresh and stored orange juice, and concluded that this fatty material had undergone oxidative changes with the development of hydroxy acids and other decomposition products, and had become rancid. In 1946, Swift (11) developed a method of determining the amount of lipid present in citrus juices and showed that all of the lipid is associated with the suspended materials. Curl (3), in 1946, compared the flavors before and after storage of whole tangerine juice and of tangerine juice from which the suspended matter, including the lipids, had been removed by filtration. He concluded that the suspended matter, probably the lipid, was responsible for much of the characteristic flavor of the juice but also was the origin of much of the bad flavor that developed on storage. He also found that the presence of peel oil masked rather than contributed to these off-flavors. The same conclusions in a similar study on orange juice by Curl and Veldhuis (4) have been mentioned.

Studies of the Composition of the Lipids by Swift and Veldhuis (12) and Swift (13). A detailed study of the composition of the lipid fraction of orange juice was undertaken by Swift and Veldhuis (12). In this work the juice was filtered using a filter-aid. The filter-aid and suspended matter was than extracted with acetone, the extract being then evaporated and the residue taken up in petroleum ether. Evaporation of the solvent left the lipid as a dark-red viscous substance. Since it was necessary to do this in small batches, the juice was first pasteurized and canned and stored at 0-5°C. (32-41°F) until it could be processed.

In Table I is given the analysis of the lipid on an "as determined" basis along with a listing of the probable composition or the most likely combinations of those items as existing in the lipid. A later study was made by Swift (13) of the fatty acids that were present.

Composition of the Lipids of Stored Juice by Huskins, Swift, and Veldhuis (6). Huskins, Swift, and Veldhuis (6) studied the effect of aging on the lipids from canned

(Continued on page 17)

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1. Presented at the Annual Meeting of the Florida State Horticultural Society, West Palm Beach, Fla., Oct. 31, 1951.
2. One of the laboratories of the Bureau of Agricultural and Industrial Chemistry, Agricultural Research Administration, U. S. Department of Agriculture.

Citrus Highlights Of The Month

Mutual Abandons Floor Price

Highlight of the month in Florida citrus circles was the action of Florida Citrus Mutual in abandoning the floor price of $1.00 per box for cannery fruit delivered in. This action came after some of the largest canners were buying fruit at prices ranging from 60 to 75 cents per box, and it became evident that the floor price could not be maintained. There also were complaints that the FOB price of $2.10 per box was being ignored by some growers and shippers and threats of prosecution for violation of contracts were freely voiced.

Corey to the Rescue

In this situation, Merton L. Corey, who took a prominent part in the organization of Mutual, was called back from New York to act as trouble shooter in the emergency. Mr. Corey is now engaged in work among the growers in an endeavor to renew confidence in the super-cooperative. Numerous grower meetings have been held at which first-hand attitude of the growers have been brought out This attitude, according to press reports, has been largely in favor of maintaining and strengthening Mutual.

Shipment Prorate Declared

In the hope of holding shipments to a lower level, a shippers prorate has been declared which would reduce shipments by about one-third. The first prorate provided for the shipment of 1000 cars of oranges and 600 cars of grapefruit for the first week of its operation. Just how well this prorate will operate is not at this writing established.

Many Remedies Suggested

With processors paying around 75c for fruit delivered in and the auctions on fresh fruit at low ebb, many suggestions have been offered, varying greatly, depending upon the source of the suggestion.

Would Permit Grove-Run Shipments

Barney Cohen, president of Florida Independent Citrus Growers, appeared before the United States Secretary of Agriculture with a proposal that shipment of grove-run fruit be permitted, the only inspection needed being compliance with the Florida citrus code. A hearing on the proposal will be held in Lakeland on February 13, at which all growers and shippers are invited to attend. But this is only one of the remedies suggested. From an organization of growers at Clearwater comes the proposal that growers should withhold at least 35 per cent of the remaining crop from market, selling only to cattlemen as stock food, and sell their remaining crop at not less than $1.25 per box for oranges and $1 per box for grapefruit on the tree.

Wants a Super-Super Cooperative

Then there is the suggestion of a super-super cooperative, one that would own, control and market the entire output of Florida groves, establishing its own processing plants and holding control of the crop from the tree to the breakfast table.

Hearings Continue

Meanwhile, meetings of growers and grower organizations are being held in an effort to iron out the critical price situation. As one well-known citrus expert says: "We are in a serious situation, but we have survived others that appeared equally as threatening. I believe that we will survive this one."

Exchange-Snow Crop Deal Fails

The much-publicized Florida Citrus Exchange-Snow Crop $32,000,000 deal, whereby the Exchange was to take over the huge processing plants of Snow Crop at Dunedin, Auburndale and Frostproof has fallen through. The stumbling block to consummation of the deal was the inability of either party to the transaction to guarantee sufficient fruit to keep the processing plants operating at somewhere near capacity. Latest report is that the Exchange plans to lease two large Snow Crop concentrate plants.

Two Great Citrus Fairs

At this writing the Florida State Fair and Gasparilla Carnival is in progress at Tampa. While taking in every phase and every element of Florida agriculture, horticulture and livestock interests, the fair by reason of its location naturally features citrus as Florida's leading agricultural product. Then, closely following on the heels of the State Fair, comes the Florida Citrus Exposition at Winter Haven, from February 18 to 23. This Exposition has gained renown as the world's greatest citrus show and the present outlook is that the 1952 Exposition will outdo all previous efforts in showing Florida's leading role in the citrus field. "Fresh Fruit Day" will be observed on Thursday, February 21, with many events planned for the day. A complete reproduction of a terminal auction sale will be staged at the Nora Mayo auditorium of the Florida Citrus Building, and awards for the best packed fresh fruit in many classifications and varieties will be announced.

Florida Citrus Men in Politics

Florida citrus interests have at least two representatives in the Florida political picture this year. Florida's senior United States Senator, Spessard L. Holland, who has been intimately associated with the industry all of his adult life, serving the industry in numerous capacities, and who is himself a citrus grower, is up for re-election and is the leading candidate in the Democratic primary. Dan McCarty, runnerup for Governor four years ago, is again a candidate for the Democratic nomination. A citrus grower and cattleman of Fort Pierce, Mr. McCarty is conceeded to be the leader in the race at this stage of the campaigning.

Bumper Crop—Low Prices

With a bumper crop of exceptionally excellent fruit, Florida citrus growers are naturally seeking the cause and trying to apply the remedy. Knowing Florida citrus men as we do, we are confident the cause will be found and the remedy applied, in time to avert any threatened disaster.

PIONEER CITRUS CANNER PASSES

(Continued from page 4)

More recently, he was a member of the National Security Resources Board, Office of Information, Washington. Purpose of this board is rapid mobilization of the nations canning industry in event of emergency.

A pioneer in Florida Citrus canning, Mr. Lindsey filled two terms also as president of Florida Canners Association, in 1927 and 1936, and was an organizer of the Canners League of Florida. He was a member of the Florida Citrus Commission Advisory Committee by appointment from the governor of Florida and held a second term until 1942.

Huge Dolomite Processing Plants Begin Operation

Florida's citrus growers received with interest the news that two new Dolomite processing plants, capable of producing more than 1,500 tons per day of the vital soil restorer, have finally gone into operation in Sarasota and Levy Counties.

The new plants, according to W. M. Palmer, president of Dolomite Products, Inc., with headquarters at Ocala, are situated at Sarasota, on U. S. Highway 41, and at Lebanon, 14 miles northwest of Dunnellon at the junction of U. S. 19 and State Road 336. Mr. Palmer said that for the first time, demand for Dolomite by citrus and vegetable growers and cattlemen during seasonal peaks can now be promptly met.

The estimated combined annual production capacity of the two plants is set at 400,000 tons.

The Sarasota mill is the operation of the Florida Dolomite Company which is owned by S. D. Gooch, his sons, W. R. Gooch and S. D. Gooch, jr, of Lake Wales, and W. H. Stuart and J. K. Stuart of Bartow. The Lebanon mill is the property of Dixie Lime Products Company, of Ocala, of which W. M. Palmer is president. Mr. Palmer's associates in Dixie Lime Products Company are J. H. Williams and W. M. Palmer, jr., vice president, and W. C. Parmeter, secretary-treasurer. The products of both companies are sold by Dolomite Products, Inc., of Ocalo, of which W. M. Palmer is president, S. D. Gooch is vice president, and W. C. Parmeter is secretary-treasurer. Sales representatives for this company are B. T. Rainey, of Ocala, and E. J. Meyer, of Arcadia.

Although Dolomite deposits are widely distributed in England, Italy and parts of the United States, it is only within the past twenty-five years that the neutralizing-nutritive attributes of the pulverized rock have been substantially recognized by Florida agronomists.

Today, many agricultural experts refer to Florida Dolomite as "nature's fundamental medicine for sick soil". Prior to its widespread use as a soil restorer or rejuvenator, Dolomite has been utilized for many purposes such as a building stone and fluxing stone for hearth furnaces.

A view of the new 60-to-80 tons-per-hour dolomite processing plant at Sarasota, Florida. This mill is owned and operated by the Florida Dolomite Company, of Pembroke, Florida. It is one of two new dolomite processing plants now in operation in Florida. The other is located at Lebanon, 14 miles northwest of Dunnellon.

Generally, Florida soils require a plant food and a soil conditioner to correct acidity. Most Florida soil is deficient in both magnesium and calcium.

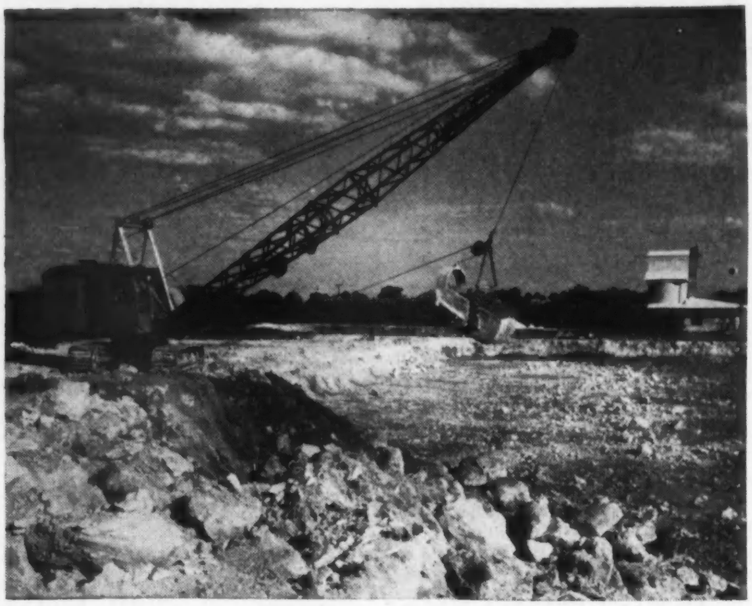
In 1934, the first Dolomite mill was erected by Dixie Lime Products Company at Lebanon. It had a maximum capacity of about 200 tons of Dolomite a day. A year later the Florida Dolomite Company constructed a similar mill near Sarasota.

At the Sarasota plant operations begin, naturally, at the quarry. Here, dry pit mining is employed whereas at Lebanon, Dolomite is mined under water. The Dolomitic rock lies approximately two to four feet beneath a layer of earth overburden. The deposit is first striped of this overburden, blast holes are drilled in the rock and the stone is broken with dynamite.

Drag lines remove the broken rock and deposit it in piles which are permitted to air-dry. To assure a continuous supply during rainy seasons, a large amount of the raw Dolomite is stored under sheds.

The analysis of the Dolomite removed from the two mines is 38 to 42 per cent magnesium carbonate and 50 to 60 per cent calcium carbonate. Actually, Dolomite is petrified marine sedimentation. At one time, Florida was below sea level and the Dolomite that is being mined today was formed millions of years ago. Workers at the mines occasionally come across interesting fossils, such as sharks teeth, petrified fish and odd skeltons.

From the quarry, the Dolomite stone is hauled in trucks to the mills. At the Sarasota operation, the raw Dolomite is dumped into a hopper which feeds into a primary crusher. The stone is automatically loaded onto a 24-inch, 150-foot conveyor belt. The belt



Here is how raw dolomite is mined. This quarry is situated near the new dolomite processing plant of the Florida Dolomite Company at Sarasota, Florida. This particular deposit is exceptionally rich in mineral content of approximately 38 to 42 per cent magnesium carbonate and 50 to 60 per cent calcium carbonate.

conveys the Dolomite to a height of about 35 feet and pours it onto what is known as a surge pile.

From the surge pile, the rock is discharged into a pan feeder which moves it along to a second conveyor belt which carries it to the maw of a metal storage silo. By gravity, the Dolomite is discharged from the silo into a 6' by 60' rotary kiln, a product of Ruggles Coles, which is a division of Hardinge Company, York, Pennsylvania.

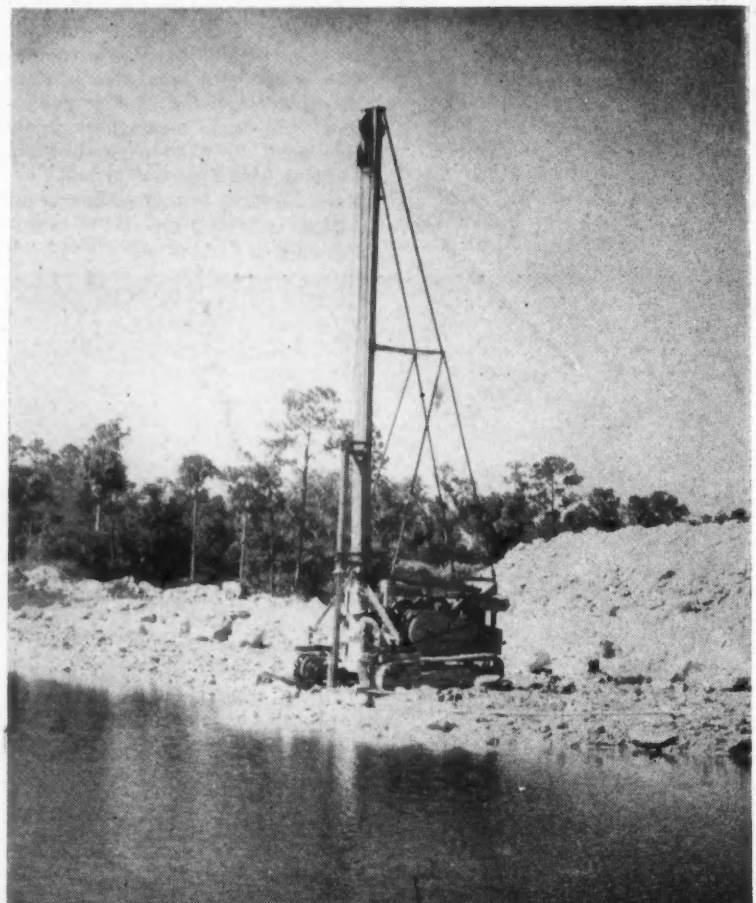
The kiln, or dryer, constantly revolving, is fired with Bunker C. fuel oil which heats 40,000 cubic feet of air per minute to more than 1,000 degrees fahrenheit. Inside this kiln, the broken raw Dolomite clatters and crashes as the 60-foot-long dryer performs its important task of extracting the moisture from the rock. While the material is being dried, cyclone dust collectors recover the extremely fine material which otherwise would be wasted. During the course of a day, it is estimated that these collectors recover 10 to 15 tons of processed Dolomite.

Leaving the rotary kiln, the dried Dolomite is fed by a belt conveyor into a 42 by 60-inch Jeffrey Pulverizer which handles 75 to 100 tons of pulverized Dolomite per hour. The pulverizer product is fed into an elevator which conveys it to a concrete storage bin. Now the Dolomite, which appears as a medium gray, soft powder, is ready for bagging and bulk loading.

From the storage bin the Dolomite is drawn into two St. Regis bag packers, each of which handles 10 to 15 one-hundred pound valve bags per minute. At Sarasota, where the plant is served by both Atlantic Coast Line and Seaboard Air Line Railroads, it is possible to simultaneously load two box cars with bagged material and two with bulk Dolomite even while trucks are being bulk loaded.

The procedure at the Lebanon mill is similar.

After passing through the dryer, the material is discharged onto a chain conveyor, thence to a short elevator where it is fed into a Jeffrey 42 by 60 hammermill for fine grinding. From the hammermill, the material discharges onto a screw conveyor and then



View of dolomite mining operations at the quarry in Lebannon, Florida.

is elevated to the top of two steel storage bins, one for loading bulk and the other for loading material for bagging. There the material is carried by a shuttle screw conveyor into either bin. In loading bulk shipments the material passes over a Merrick Weightometer for accurate weighing, thence through a shuttle screw conveyor for loading trucks or box cars. A Stephenson-Adamson carloader is used for loading railroad cars. For bagged material, the Dolomite flows from one bin into two St. Regis packers where the material is automatically packed in 100-pound multiwall paper valve bags.

The two mills now employ about 60 workers. In recent months, a paved limerock road was constructed from U. S. Highway 41 to the site of the Sarasota mill, primarily for the convenience of trucks.

Dolomite's remarkable properties as a soil conditioner are not confined to groves, field and truck crops and pasture rejuvenation. It is equally effective for lawns, flowers, shrubs and any other plant that thrives in properly balanced soil. Of course, it should not be used with acid-loving plants such as azaleas.

d/p Dolomite is distributed to virtually every county east of the Suwannee River. It is sold through fertilizer manufacturers and dealers as well as by direct sales to consumers.

"We believe that these two new plants can and will play an important role in the development of Florida agriculture," Mr. Palmer said. "And we are confident that Dolomite will help to solve the neutralizing-nutritional problems of Florida's soils."

SOME RESULTS OF IRRIGATION RESEARCH WITH FLORIDA CITRUS

(Continued from Page 8)

In addition to measuring the juice constituents as affected by irrigation, Valencia oranges, held until the latter part of June, 1950, were checked to ascertain the extent of granulation or dryness at the stem end of the fruit. Fruit from irrigated trees was found to have an average of 61.8 percent of the fruit with all sections dry to ½ inch, as contrasted to an average of 35.3 percent for fruit from the unirrigated plots. Only 10 percent of the fruit from irrigated trees was entirely free of dryness, whereas, 27.9 percent of the fruit from the unirrigated trees had no dry sections. These results indicate that the keeping quality of Valencia oranges on the tree was impaired by the use of irrigation.

The size of the fruit produced from irrigated trees has, on the average, been larger for both oranges and grapefruit. This means that a lower TABLE 6—Juice Consti. of Or. .... percentage of the orange crop would be size 288 and smaller, and a smaller percentage of grapefruit produced would be smaller than size 80. From information thus far obtained, it appears that a deficiency of soil moisture at any time during the growing season may have an appreciable effect on the size of fruit obtained. The amount of irrigation applied during any one year in these experiments has been equivalent to an increase in the size of oranges of approximately 0.10 inch in diameter, and 0.20 inch in the diameter of grapefruit. This in-

crease is slightly less than one commercial size for these fruits.

One of the apparent differences which has been evident during the past year or so has been the increase in size of the trees due to irrigation. The differences were not evident when the experiment was started so no measurements were made at that time. Table 7 shows the average height and circumference of the trees receiving the irrigation and no irrigation treatments in Block XIX, as of September, 1951. No measurements were made for other varieties, but size increases of about the same magnitude have been observed.

Production records from the Sample grove during the last five years have consistently shown appreciable

Table 7
Average Height and Circumference of Duncan and Marsh Grapefruit Trees After Three Years of Irrigation

Treatment	Plots	Height (Feet)	Circumference (Feet)
		Duncan	
Irrigation	1-3-5	17.1	70.1
No Irrigation	2-4-6	15.3	62.2
		Marsh	
Irrigation	1-3-5	16.9	68.4
No Irrigation	2-4-6	15.5	60.1

increases in production of both oranges and grapefruit from the use of irrigation. The average annual increase in production has varied from approximately 0.5 to 1.1 boxes of fruit per tree for Valencia oranges and from 1.5 to 2.5 boxes per tree for Marsh grapefruit. A summary of these data is presented in Table 8. As yet there is no consistent correlation evident between the **amount** of irrigation applied and the yield of fruit obtained, although in the orange data there is a trend in this direction. The difference in yield are significantly higher where 3½ inches of irrigation was applied than in the unirrigated plots, or in those to which 1½ inches of irrigation was applied.

Contradictory production figures have been obtained from the Citrus Experiment Station irrigation plots. In 1949 and 1951 significant differences in production were noted only for Marsh and Duncan grapefruit varieties which produced from .64 to 2.20 more boxes of fruit per tree where irrigation was applied. During the 1950 season significantly higher yields were obtained for all varieties in the experiment (Hamlin, Pineapple, Valencia, Duncan, Marsh) where no irrigation

Table 8
Production Summary, Valencia Oranges and Marsh Grapefruit Over Five Year Periods as Affected by Amount of Irrigation Water Applied
(Sample Grove, Haines City, Fla.)

Year	Inches Irrigation Water Applied							
	0	1½	2½	3½	0	1½	2½	3½
	Average Boxes of Fruit Per Tree							
	Marsh Grapefruit				Valencia Oranges			
1950	6.15	7.49	6.73	7.71	7.02	8.03	8.51	8.98
1949					5.72	5.81	5.60	5.90
1948	13.09	12.00	11.19	10.68	7.94	9.23	9.00	9.95
1947	10.11	12.43	13.01	13.80	3.70	4.63	5.08	5.33
1946	9.65	17.74	14.82	13.86	5.25	5.03	5.34	5.62
Average	9.75	12.41	11.44	11.51	6.06	6.55	6.78	7.16
Per Tree Difference Over No Irrigation		2.66**	1.69**	1.76**		0.51*	0.72**	1.10 *

* Significantly higher than the yield from unirrigated trees at 5% level.
** Significantly higher than the yield from unirrigated trees at 1% level.

was applied. The increase in yield for 1950 from the unirrigated trees varied from approximately 0.5 to 1.1 boxes of fruit per tree. A summary of these data is presented in Table 9.

Discussion

The question arises as to how these differences in internal quality and production affect the grower, processor or consumer of citrus. The lowering of the soluble solids content of the juice by irrigation is simply another factor which the grower must respect when raising early oranges or seedless grapefruit or when growing fruit to be used for concentrate production. Delayed marketing of Hamlin and Parson Brown oranges due to low soluble solids content is of frequent

occurrence. Where previous difficulty has been experienced in getting crops of these varieties on rough lemon stock to meet the minimum soluble solids requirements, irrigation later than June should not be used unless absolutely necessary to prevent preharvest fruit drop.

The effect of irrigation on fruit to be used in the preparation of frozen concentrate presents a somewhat different and more devious problem. The data presented support the assumption that in most cases the lowering of the soluble solids and acid content of the fruit is largely a matter of dilution. This is of no particular importance unless the concentrate plant buys the fruit on the basis of its soluble solids content. When this happens, the grower is then faced with the proposition of spending money for irrigation which will produce fruit which he must sell at a lower price. To offset this particularly unfortunate set of circumstances he must have the assurance of increased yield, and with this increase he must gamble that the market will be sufficiently high so that the additional fruit produced will more than compensate for the cost of the irrigation plus the loss due to a lower selling price because of the lower soluble solids content of the fruit. These are factors which any grower using irrigation should consider and which growers with elaborate overhead systems that may be put into operation by the push of a button most certainly must consider.

Savage (2), in his recent paper, pointed out that during years of low fruit prices, unirrigated groves showed a greater net return than irrigated groves, and that the average returns above operating costs for the past nine seasons 1941-

Table 9
Production Summary, Oranges and Grapefruit as Affected by Irrigation, Block XVIII & XIX 1949-51

Treatment	Average Boxes of Fruit Harvested Per Tree					
	1949	Difference	1950	Difference	1951	Difference
Hamlin Oranges						
Irrigated	4.21	.18	2.68		3.75	
Unirrigated	4.03		3.64	0.96**	4.35	.60
Pineapple Oranges						
Irrigated	2.71	.11	1.37		3.29	
Unirrigated	2.60		2.22	0.85**	3.80	.51
Valencia Oranges						
Irrigated	1.36	.05	1.81		3.24	
Unirrigated	1.81		2.30	0.49**	3.41	.17
Duncan Grapefruit						
Irrigated	7.76	1.31**	1.07		8.59	.64*
Unirrigated	6.36		1.96	0.89**	7.95	
Marsh Grapefruit						
Irrigated	8.61	1.05**	1.03		10.44	2.20**
Unirrigated	7.56		2.14	1.11**	8.24	

* Difference significant at 5% level.
** Difference significant at 1% level.

1950 was $14 more per acre for non-irrigated groves than for irrigated ones. It is not to be concluded from these and similar studies that irrigation is without merit in the citrus culture program, but it shows that it is necessary to learn when and how to irrigate properly. Results obtained from the Sample grove experiment provide evidence that consistent increases in yield can be obtained through the use of irrigation. Results of similar experiments at the Citrus Experiment Station, however, show that yield increases are not necessarily to be associated with the use of irrigation and that decreases may occur. Reconciliation of these differences in light of present knowledge is not possible, but it is interesting to observe the possible effect of differences of timing of irrigation in these two experiments. The plots at the Citrus Experiment Station have been irrigated in November every year since the experiment was started, whereas, the plots at the Sample grove have never been irrigated in November except during 1948. In the Sample grove the yield of Valencia oranges in 1949, (Table 8), following the November, 1948, irrigation, was low and there was no appreciable difference between the yield of the irrigated and nonirrigated trees. Except for the first year of the experimeint, 1946, the 1949 year was the only one in which the irrigated trees failed to outyield the nonirrigated trees. These data, of course, actually offer no proof that harmful effects result from early winter irrigation, but the finger of suspicion is certainly pointed in that direction.

This report is not intended to discourage irrigation but rather to point out that there seems to be more involved in its use than simply delivering and applying the water to the soil. The information already obtained is helpful in explaining the reasons for high and low fruit quality years and in understanding what changes take place in fruit quality with the use of irrigation. There is still need, however, for a more precise method of determining just when irrigation should be applied, the relationship between soil moisture and abscission layer formation, fruit drop, splitting, flower bud initiation, fruit setting and other factors. Securing precise information on these subjects will of necessity take considerable time, for irrigation experiments are subject to the whims of the weather and it often requires several years for a particular set of conditions necessary to prove a particular point to come along.

Summary

1. Trees grown under conditions of continuous abundant soil moisture produced fruit high in juice, low in soluble solids and low in acid content.

2. Differences in composition of fruit harvested from irrigated and nonirrigated trees could, under most conditions, be largely accounted for by dilution.

3. Extended drought conditions

during the early part of the fruit season (approximately 100 days more or less from date of bloom) appeared to favor the development of fruit with high acid content.

4. Extended drought conditions during the middle of the fruit season (between approximately 100 to 200 days from bloom) appeared to favor the development of fruit with high soluble solids and moderately high acid content.

5. Drought conditions during the later part of the season appeared to have little or no effect on the quality of fruit produced, but soluble solids and titratable acid were lowered by rain or irrigation during this period.

6. Fruit size and tendency toward granulation were also affected by soil moisture conditions.

7. Production of citrus fruit as affected by irrigation was variable in the two irrigation experiments studied.

8. Irrigated trees grew more rapidly.

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2. Savage, Zach. Irrigated and nonirrigated groves. Citrus 14: 23. Oct., 1951.

FLAVOR CHANGES IN STORED CANNED ORANGE JUICE

(Continued from page 9)

orange juice that had been stored in the loft for 2 years. The temperature of the loft is not known, but it would be comparable to that under drastic warehouse conditions. The lipid was then extracted by much the same procedure as that used with freshly-canned juice except that pilot-plant equipment was employed.

Upon analysis it was found that the most noteworthy changes in the lipid from the aged juice were in the contents of phosphorus and nitrogen. The phosphorus had decreased to one-tenth of its original value and the nitrogen to one-fifth. Choline had entirely disappeared. It thus appeared that the phosphatide fraction had broken down on storage, freeing the nitrogen compounds and the phosphate part of the molecule which, being water-soluble, were then lost to the lipid. This hypothesis is supported by the fact that the amount of lipid that can be extracted has been found to decrease when juice is stored. However, since these lost substances are not highly-flavored and are liberated in small amounts, it did not seem likely that they could account directly for the flavor deterioration. There remained a possibility that the freed nitrogen compounds might react with some constituents of the aqueous part of the juice to form objectionable substances.

EXPERIMENTAL

Pack Studies in Progress. To answer in a practical way these and other questions as to the causes of flavor deterioration of stored juice, pack studies are being conducted at the Winter Haven laboratory of the Bureau.

Choline, ethanolamine, and a phosphatide were added separately in water solution to packs of whole and filtered juices and to a synthetic juice. Whole peel oil, a 10-fold concentrated oil, and terpeneless oil were added separately in alcohol solution to packs of filtered and synthetic juices. All additives, in amounts previously calculated to give the desired concentrations, were placed in the cans before

(Continued on page 20)

ADVERTISEMENT — LYONS FERTILIZER COMPANY

The LYONIZER

Department

COMPILED BY THE LYONS FERTILIZER COMPANY

Reports Of Our Field Men . . .

SOUTHWEST FLORIDA
Eaves Allison

Recent cold weather and raw winds have had their effect on vegetable crops here and have taken their toll in retarded growth and bruised foliage. However, no killing frosts or freezing winds have yet been experienced and many fall crops are still picking.

Citrus quality is steadily improving, with no parallel improvement in the return to the growers. The latter are not at all happy over the way their balance sheet is going.

The outlook for the spring deal in this area is very optimisitic and all signs point to a very busy vegetable planting season, which the Lyons Fertilizer Co., will have a big part in making successful.

NORTH CENTRAL FLORIDA
V. E. Bourland

Weather conditions have been cool, damp, nights and mornings with heavy fog, and mid-day heat which has been bad on fruit, blue mold is showing up considerably in some groves. Still lots of fruit dropping. Most groves are looking good under the conditions and some of growing buds are beginning to show. Fruit prices are still very discouraging. Red spider is working in lots of groves, and a number of growers are spraying.

Truck farmers who have cabbage are feeling very good as they are getting $3.75 to $4.00 for 50 lb. bag, or $8.00 per hundred F. O. B. at field, and we have some very nice fields of cabbage. Ground is being prepared for cucumbers. Melons are more or less at a standstill at the present time.

SOUTH POLK, HIGHLANDS AND HARDEE COUNTIES
C. R. Wingfield

The citrus industry has come face to face with a crisis that is a threat to one of the largest resources of the state. It can be overcome by a cooperative effort on the part of all concerned. With a large part of the crop still to be harvested.

The lack of moisture is becoming serious and without rain before this article goes to press we will find most groves being irrigated. Some have already begun while others are making ready for the job. With the temperatures high and moisture is applied we can look for a growth. Shallow cultivating at regular intervals has conserved our moisture in many cases to keep the trees out of a wilt.

Red spiders are still working and in most cases where found in damaging number the control has been applied. Keep a close check on this pest.

PASCO AND EAST HILLSBOROUGH COUNTIES
E. A. McCartney

We are in need of rain in this territory. Some groves are being irrigated, but due to the carry-over of midseason and seedling oranges most growers are going easy on this practice because of the slow movement of fruit and heavy dropping. Growers in this territory have eased up on their fall application of fertilizer and will use a high nitrogen starting about Feb. 15.

The vegetable deal in Plant City and Webster section is going along in good shape. Webster is producing more lettuce than heretofore. They expect to harvest at least 100,000 crates of lettuce and probably more depending on the weather conditions. This should turn out to be a good money crop for that area.

WEST CENTRAL FLORIDA
J. E. Mickler

The beginning of a New Year makes this month a little different in that it sees the usual new resolves, the reviewing of mistakes made in the old year, and the preparation for another struggle. This new year begins for some in the fruit business as a question. What prices will be and the effect overall of the present prices on the future.

Warm weather has made Spring in January. Trees are pushing out new buds, melons are sprouting, and grasses are looking better.. Moisture level is good for most of the section, and promise of more rain. If this weather holds it will hasten fertilization programs of pastures and mark a better beginning for cattlemen.

PINELLAS COUNTY
T. D. Watson

For the entire month of January it has been unseasonably warm which has caused earlier maturity of all varieties of citrus and virtually ruined what was left of early varieties of fruit.

In some areas there has been a heavy infestation of red spiders that it was absolutely necessary to use a DN spray to control them. Dry weather added to this menace considerably.

Watermelon growers have practically all finished planting. Some have fairly good stands and with warm weather prevalent and good moisture in the ground they should grow off rapidly.

In my territory there has been quite a bit of interest in early top-dressing of improved pastures particularly pangola grass. This will give an early start with almost immediate grazing.

Everyone is hoping for a better price on citrus as we go into the Valencia crop.

POLK AND HIGHLANDS COUNTIES
J. T. Griffiths and J. K. Enzor, Jr.

Dormant spray applications in most groves were applied by the end of January. Purple mites continue to be troublesome in some groves, but serious injury has not generally occurred.

Growth started in many groves and in a few instances, particularly Hamlins, bloom has been heavy and general thorughout the block. Growth is sufficiently common that growers should be careful in applying DN sprays. DN-111 is safer than DN Dry Mix and DN dust is generally safer than a DN spray. Purple scale, and in some instances red scale, has remained throughout the winter months in some groves. It would be desirable to plan now for scalicide application either just before or after bloom time.

Leaf drop has been general in many groves. This is particularly true on tangerines. In tangerines, while "greasy spot" is sometimes a factor, most of the leaves show yellow midribs, and it is old foliage which is falling. This has been true in almost all of the tangerine groves observed all the way from Avon Park to Clermont. In some instances Valencias are beginning to drop fruit. This condition started in late December and in some groves will be worse as the Spring progresses.

Spring fertilizer and top dresser applications are well under way.

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Uncle Bill Says:

Like everybody else who is connected with this citrus business we're feeling sorta glum right now 'cause of the low prices which our fruit is bringin'.

We hear folks offerin' all sorts of remedies for the situation all the way from puttin' a limit on the amount of acres that can be planted to citrus fruit, to eliminatin' all effort to try to work out a cooperative arrangement of marketin' our fruit and lettin' Nature take its course, and even some folks who say they ought to name a citrus dictator who could be given authority to handle the whole deal.

Personally we don't claim to be no hot shot expert, but when it comes to limitin' the amount of acres of grove a man can have seems sort of unreasonable to us, 'specially with all the acres that has been abandoned in Texas and with the trouble California is havin'. Likewise we ain't in favor of doin' away with the cooperative effort of growers to handle their fruit in a way which will benefit the industry. We have operated on a "let nature take it's course" plan many times in the past and found ourselves in a worse condition than we're in today. And this business of havin' a dictator handle our fruit somehow just don't set right.

So without havin' any sure fire plan to iron the kinks out of our industry we still adhere to the firm belief that whatever our troubles are at the moment the citrus industry and those intelligent folks who go to make up that industry will work out their difficulties just as they have so often done in the past.

Remember when we had that epidemic of banks failin'?

Remember when we thought the industry was lost on several occasions when serious freezes ruined our crops and killed a lot of trees?

Remember when on other numerous occasions severe drouths put most of the fruit on the ground?

Remember when the Mediterranean fruit fly business forced us to lose a lot of that season's crop?

We'll bet there are a number of times when you can remember troubles that had the industry in a much worse fix than it's in today . . . and then you can also remember how we always pulled out of it and went ahead and prospered as no other agricultural industry has ever done.

We've come out of a lot of bad spots in the past . . . and we'll come out of this one just as we have done before.

FLAVOR CHANGES IN STORED CANNED ORANGE JUICE

(Continued from page 17)

filling.

The sources and specifications of the added materials were as follows:[2]

Choline Hydrochloride—Eastman No. 1122 (Calculated to free base).

Ethanolamine—Eastman No. 1597

Phosphatide, Glidden's RG grade Soya lecithin. This contains lecithin and cephalin.

Peel Oil—a commercial grade from 1951 crop.

Peel Oil, 10-fold—a commercial concentrated oil.

Terpeneless or de-limonened Peel Oil—Prepared from the peel oil noted above by the chromatographic method of Kirchner and Miller. (7).

The whole and filtered juices used were from 1951 Valencia oranges, the latter being prepared by passing the whole juice from the Fauld's Rotary[2] extractor through an Oliver[2] continuous filter using Hyflo-Supercel[2], as the filter-aid. This filteration reduced the volatile oil content from 0.04 to 0.006%.

2. The mention of brand names does not imply any special preferment by the Department of Agriculture over other similar products.

In the preparation of the synthetic juice the aim was to reproduce from known materials a mixture having as nearly as possible the sugar system, acidity, buffers, and ascorbic acid of a natural juice, but having the advantage of containing no trace of peel oil. To this end half of the sugar as sucrose and all of the citric acid for the whole batch were put into solution and heated in a steam-jacketed kettle until inversion of the sugar was complete, as determined by saccharimeter readings. After cooling, the rest of the sucrose, some potassium citrate as a buffer, and some ascorbic acid were added and the mixture was diluted to the final volume in a tank equipped with a mechanical stirrer. The final composition was as follows: 5% sucrose, 5% invert sugar, 1% citric acid, 0.7% potassium citrate, and 0.05% ascorbic acid. Part of each pack was stored at C-5°C. (32-41°F.) and part at 27°C. (80°F.). The whole juice packs were stored for 9 weeks, the filtered juice packs for 14 weeks, and the synthetic juice for 6 weeks, these storage periods being more or less dictated by outside circumstances.

Limonene alone was added to the whole orange juice, the filtered juice, and to the synthetic juice, but in all cases except that of the whole juice, it gave rise to an anise or caraway-like flavor that was quite different from any observed with peel oil. According to Guenther (5), this caraway-like flavor in limonene is evidence of autooxidation which may have occurred previous to its use, although it appeared normal when introduced into the cans. For this reason the results from it were excluded from the tables.

RESULTS AND DISCUSSION

The flavor deterioration of the whole juice after 9 weeks storage at 27°C. (80°F.) was so far advanced that any effects of the added

Table III
Effect of Additives on the Flavor of Canned Synthetic Juice After Storage at 35°F and 80°F for 6 weeks

Additive	Comments on Examination	
	35°F (average)	80°F
Control	Clear. Freshly packed taste	Clear. Freshly packed taste.
Phosphatide 0.06%	Slightly turbid. Some buffering & taste	Slightly turbid. Similar to phosphatide at 35°F.
Choline 0.01%	Clear. Same as control.	Clear. Same as with 35°F. storage.
Ethanolamine 0.01%	Clear. Some buffering of sourness.	Clear. Same as with 35°F. storage.
Peel oil 0.03%	Clear. Good flavor.	Clear. Some typical aged flavor.
Peel oil 0.003% delimonened	Clear. Slightly different from peel oil.	Clear. Fairly typical aged flavor. Definitely different from 35°F. storage.

Table I
Analysis and Probable Composition of Orange Juice Lipids from 1947 Valencia Oranges

Analysis (as determined).		Probable Composition	
Volatile in steam	0.17%	Volatile in steam	0.17%
Unsaponifiable	14.81	Unsaponifiable	14.81
Resin acids	12.41	Resin acids	12.41
Sterol Glycoside	1.48	Sterol Glycoside	1.48
Fatty Acids, free	21.00	Fatty Acids, free	21.00
Fatty Acids, total (Ave. M.V. 273, I.V. 113)	59.00	Fatty Acids, combined (possibly with sterols, not accounted for below)	13.6
Glycerol	3.43		
Choline	2.36	Lecithin	15.3
Nitrogen	0.61	Cephalin	18.0
Phosphorus	1.40		
			96.77%

Table II
Effect of Additives on the Flavor of Canned, Filtered Orange Juice after Storage at 35°F. and 80°F. for 14 weeks

Additive	Comments on Examinations	
	35°F (average)	80°F
Control	Little change from freshly-packed tastes clear.	A very slight aged flavor.
Phosphatide 0.02%	Slightly turbid, Little different from control	Slightly turbid. Slight aged flavor similar to 80° Control.
Phosphatide 0.06%	Slightly turbid, Similar to .02% phosphatide	Slightly turbid. Simialr to 0.02% phosphatide at 80°F.
Ethanolamine 0.01%	Clear. Same as control	Clear. Same as 80°F. control.
Choline 0.01%	Clear. Same as control	Clear. Same as 80°F. control.
Peel oil 0.03%	Slightly turbid. Some aged flavor.	Slightly turbid. Considerable aged flavor.
10 Fold peel oil 0.003%	Clear. Little aged flavor	Clear. Considerable aged flavor.
Peel oil 0.003% (delimonended)	Clear. Little aged flavor.	Clear. Considerable aged flavor.

materials were overshadowed and differences in flavor could not be detected.

The filtered juice (Table II) was found to show little if any flavor change after storage for 14 weeks at 0-5°C. (32-41°F.), but did have a slight aged flavor at 27°C. (80°F.). The added phosphatide, choline, and ethanolamine did not appear to have much effect at either temperature. The added oils, on the other hand, all produced slight aged flavors at 0-5°C. (32-41 F.) and considerable typical aged flavor at the higher temperature. These results from the straight peel oil and from the 10-fold oil tend to support Blair's terpene theory, but the same result from the terpeneless oil tends to refute it. However, as Blair has pointed out, filtering the juice does not entirely remove the original peel oil and the terpenes from this source are still present to some extent. Nevertheless, the fact is pertinent that the whole juice, while containing but little more oil than the filtered sample, still underwent much more profound deterioration. This suggests a far more complicated phenomenon than can be accounted for by changes in the terpene part of the peel oil alone.

With the synthetic juice (Table III) the results are much the same as with the filtered juice. None of the additives that have been so far tried and that could have come from the lipid seemed to contribute to the flavor deterioration. On the other hand, the addition of peel oil definitely did give a typical storage taste. This result again suports Blair's theory if it can be assumed that the terpene constituents were responsible for the off-flavor that developed. However, the fact that the terpeneless peel oil gave the same typical stored flavor suggests the possibility that some constituent other than the terpenes might be the source, providing, of course, that the terpenes had been effectively removed by the chromatographic treatment.

The foregoing evidence does not identify the substance or substances that give rise to the typical pungent off-flavor that develops in orange juice on storage. One might speculate that carotenoid compounds play a role since whole juice deteriorates more rapidly than filtered juice from which most of these constituents has been removed. This hypothesis also receives support from the fact that all cold-pressed peel oils, whether whole or concentrated by distillation or chromatography contain these substances. In addition, orange juice with its higher carotenoid content is generally considered to undergo this particular form of deterioration more rapidly than does grapefruit juice. On the negative side, however, the amount of carotenoids present in any case is so small that it is difficult to see how these substances could cause such extensive damage. There is certainly nothing so far in the experimental results to definitely exclude any constituent of peel oil.

More work on this approach to the problem is still in progress and may throw further light on the explanation of the phenomenon.

CONCLUSION

At the present stage of the investigation the bulk of the evidence seems to indicate that peel oil is a source of the typical storage flavor that develops in orange juice on storage. It is not yet clear that the terpene fraction of the oils are responsible. Lipid constituents may also play a role.

At the Winter Haven Station further work is now in progress. It is proposed to add other fractions of the lipid and modified peel oils to synthetic juice in an effort to learn more about the nature of the flavor changes.

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1951 FARM SAFETY PROGRAM YIELDS FEWER ACCIDENTS

The Florida Safety Council's annual survey of farm accidents and fatalities shows a decline in 1951.

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Citrus workers should be more careful when using aluminum ladders. Several, recently have been killed by coming in contact with live wires.

"The Safety on the Farm Program" inaugurated in 1938, by Com. Nathan Mayo is today nationwide and has resulted in the saving of many farm lives and improved farm conditions throughout the nation. All state farm agencies are cooperating in the **"Safety on the Farm Program"** which has done much to remind the farmer of the need for caution in the home and on the farm—Agricultural Inspectors, Vocational Teachers, the Extention Service, the Press and others have cooperated in this program.

Electricity, the telephone and modern highways have done much to bring city and country closer together, but the farmer is still his own doctor, engineer and mechanic and is doing everything he can to protect his family, workers and equipment.

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